Central Province Shellfish Resources and their Utilisation in the Prehistoric Past of Papua New Guinea

BY

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(4 Text figures)

INTRODUCTION

Shells, broken pottery and worked stone show that many Central Province beach fronts, hillslopes and ridges were once occupied by human settlements. While many of these abandoned villages were occupied in traditional times, there are others whose history is not known. Certain of these old sites have now been excavated by archaeologists. The radiocarbon readings made from charcoal out of their old fireplaces show some to be 2 000 years old. Hence edible and other molluscs have been gathered from along Central Province shores from before the time of Christ until now. This finding demonstrates that shellfish have been a long valued and viable natural resource in this area.

In the past it is unlikely that the available natural resources were placed under such continuous pressure as they are today. Towards the end of the 19th century coastal settlements in the vicinity of Port Moresby varied greatly in population. Some were only small groups of a few houses, whereas others consisted of up to 120 dwellings (Turner, 1878). Today most settlements in the Port Moresby area are experiencing a rapid population increase. For instance, Pari village appears to have increased from about 140 persons in 1910 to about 650 in 1961. Its present population is in the order of 1 400 people (I. Maddocks, U. P. N. G., personal communication, 1974). Unfortunately this population increase and its associated rise in demand has made shellfish a delicacy for many of Port Moresby's coastal residents. Some beds, such as those of *Atactodea striata* (Gmelin, 1791) along Ela Beach are said to be virtually depleted (W. Dihm, Vabukori village, personal communication, 1974). The consequence is that tinned fish is now being bought to fulfill a need previously met by local shellfish resources.

THE DISTRIBUTION OF EDIBLE SPECIES ALONG THE CENTRAL PROVINCE COASTLINE

All shellfish species have certain food and substrate requirements. Each species thrives best where these conditions are met. Thus the edible shellfish found along any specific stretch of coastline are a reflection on the existing environmental conditions.

The coastline in the immediate vicinity of Port Moresby is indented by numerous embayments. Steep hills form bold promontories and coastal headlands which are fringed by reefs that are generally less than 100m wide. Between the headlands are smaller coastal bays lined either with sandy beaches or dense mangrove swamps. The fringing reefs associated with these bays often extend more than 1 km. Offshore are a number of islands. Some are located on an enormous east-west trending barrier reef system.

Large coastal fringing reefs are restricted from Lealea to Bootless Inlet in the Port Moresby area (Figure 1). East of Bootless Inlet until Mailu Island the coastline lacks offshore islands and extensive fringing coastal reefs. Estuarine systems occur at Hood Lagoon, Marshall Lagoon and Abau; otherwise, sandy beaches line the shore and the discontinuous barrier reef is ribbon-like in nature.

West of Port Moresby from Kido to Galley Reach and also further west in Hall Sound are broad tidal flats with dense mangrove communities. Open sandy beaches are present along the Hisiu coastline and further west at Waima. A narrow fringing coral reef extends from east of Cape Suckling to Delena and Yule Island.

The widely extending coral reef platforms found in the Port Moresby area provide an extensive intertidal zone where herbivorous molluscs can feed. The most gathered herbivorous molluscs are members of the Strombidae and

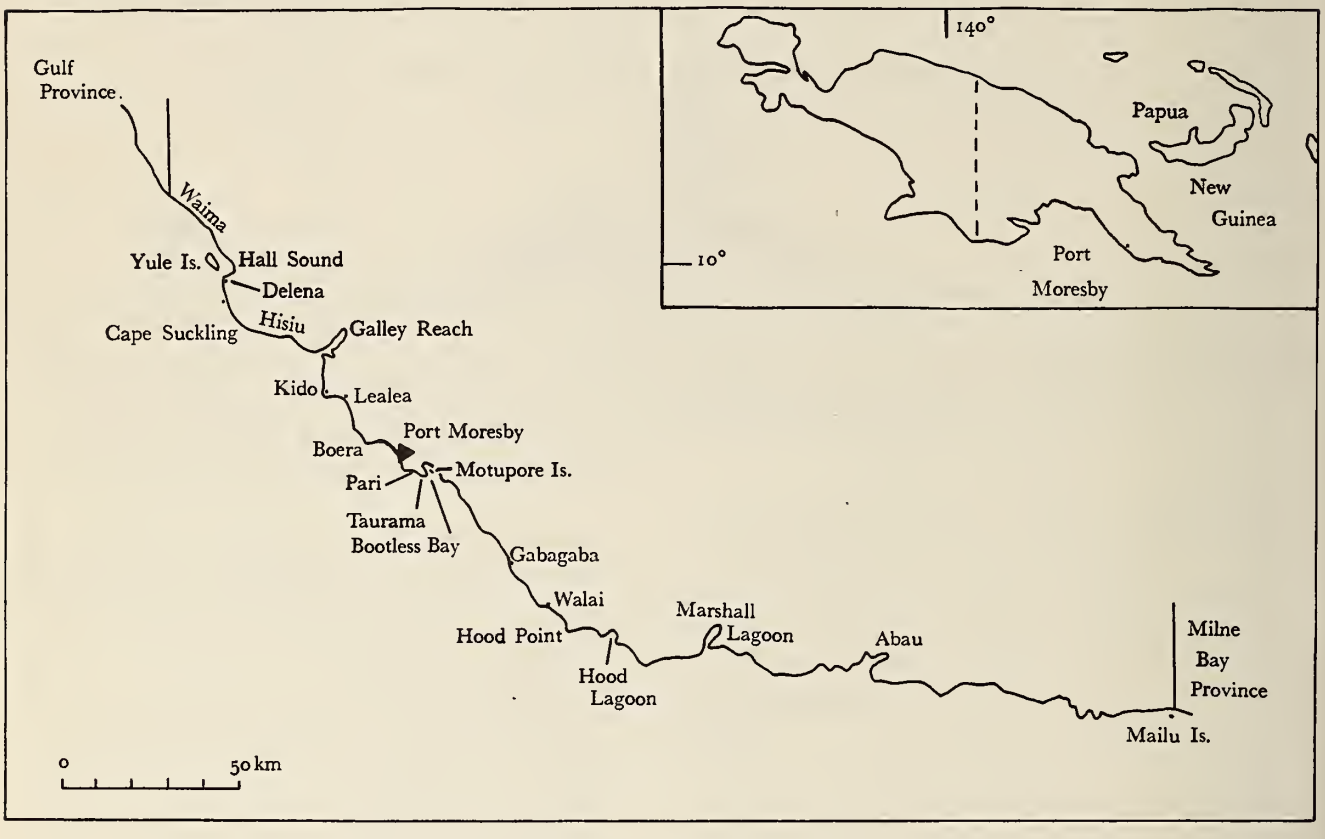


Figure 1

Central Province Coastline

Neritidae families. Some filter feeders are also found. The small *Atactodea striata*, for instance, is found in the lower beach sand of sheltered bays. On the narrow fringing coastal reef east of Port Moresby *Anadara antiquata* (Linnaeus, 1758) is the main food species found. In the mangrove areas *Geloina coaxans* (Gmelin, 1791) and *Telescopium telescopium* (Linnaeus, 1758) predominate. The open sandy beaches are considered to be barren of edible species.

The extent to which environment influences distribution is evident when a comparison is made of the species gathered in areas with different natural environments. This contrast is apparent in Tables 1 and 2. The species gathered from the sheltered, silty, mostly mangrove clothed shores around Delena are with few exceptions very different from those from the more extensive rocky and coral reef coastline at Pari.

TRADING SHELLFISH TO OFFSET THE NATURAL DISTRIBUTION PATTERN

The uneven distribution of certain culturally important shellfish along the south Papua coast has undoubtedly played a part in past trading networks. The high value attached, for instance, to cone shell ornaments along the south Papuan coast must not only relate to their beauty, but also to the natural scarcity of large cones even in favourable areas. Being at the apex of the food chain

Table 1

Main Species Gathered For Food at DELENA

Bivalves	Gastropods
Geloina coaxans (Gmelin, 1791)	*Strombus canarium* Linnaeus, 1758
Anadara granosa (Linnaeus, 1758)	*Nerita* species
Anodontia philippiana (Reeve, 1850)	
Codakia punctata (Linnaeus, 1758)	
Gafrarium tumidum Röding, 1798	
Lucina corrugata Deshayes, 1843	
Placuna placenta (Linnaeus, 1758)	
Tapes literata (Linnaeus, 1758)	

Table 2

Main Species Gathered For Food at PARI

Bivalves	Gastropods
Anadara antiquata (Linnaeus, 1758)	*Strombus luhuanus* Linnaeus, 1758
Asaphis violascens (Forskal, 1775)	*Strombus gibberulus gibbosus* Röding, 1798
Atactodea striata (Gmelin, 1791)	*Strombus urceus* Linnaeus, 1758
Gafrarium tumidum (Röding, 1798)	*Lambis lambis* (Linnaeus, 1758)
Hippopus hippopus (Linnaeus, 1758)	*Littorina scabra* (Linnaeus, 1758)
Tridacna crocea Lamarck, 1819	*Nerita* species
Tridacna maxima (Röding, 1798)	*Turbo crassus* Wood, 1828
Tridacna squamosa (Röding, 1798)	

they feed on worms, other molluscs and some even kill and eat small fish. The lack of a reef platform along the Gulf Province coast, a situation which continues as far as Yule Island, means that cones and other reef dwelling species are absent. Even at Delena, where the reef begins, cone shells are seldom found and then only in deep water.

At the beginning of this century, Seligman observed that toea, armshells made from large cone shells such as *Conus leopardus* Röding, 1798, were traded to Port Moresby communities from the east. Many of these toea had an ultimate origin in the vast expanse of archipelagos and reefs of the Milne Bay Province. They reached the Port Moresby area after a large number of successive trading exchanges. These imported toea, along with those made by the Motuans from shells found on the Port Moresby reefs, apart from being an important part of brideprice, were used as an item of exchange during organised trading expeditions to the Gulf called hiri. If large enough for an armband, each toea was considered payment for 110 - 350 kg of sago; whereas a large cooking pot would get about 40 kg and a small one 20 kg (BARTON, 1910: 115). Today the Mailu continue to bring toea made from Milne Bay cone shells to Port Moresby, where these armshells still play an important part in brideprice transactions (P. Hetyey, U. P. N. G., personal communication, 1974).

Apart from ornamental shell, edible shellfish were also traded. Evidence that this occurred in the prehistoric past is the material found in archaeological sites. The Obu archaeological site, for example, is inland from the open Hisiu sandy shore. The shellfish species found in the midden come from mangrove and coralline or rocky shores. The main species found were *Anadara granosa* (Linnaeus, 1758), *Geloina* sp., *Telescopium telescopium*, *Neritina ziczac* (Sowerby, 1819), *Strombus luhuanus*, *Nerita undata* Linnaeus, 1758 and *Planaxis sulcatus* (Born, 1780) (SPECHT, 1974: 49). The nearest mangrove area where the first 4 species could have been obtained is 13 km to the east. Another example of such trade is the presence of marine species in the Nebira 4 midden, some 16 km inland from the Port Moresby coast (ALLEN, 1972: 122-123). Trade in edible species continues today. *Geloina coaxans* and *Telescopium telescopium* are common items in Port Moresby markets. Most originate from the Galley Reach area to the west. In the Hall Sound area Delena villagers continue to trade *G. coaxans* with the inland dwelling Mekeo for agricultural produce and lime made from previously bartered shells.

A LONG-TERM VIEW OF SHELLFISHING ON THE PARI-TAURAMA SHORELINE

The distribution of shellfish at Pari varies along the coastline. The areas where there are good beds or concentrations of certain shellfish are well known and named by the local residents. This is demonstrated in Figure 2 which shows the main Pari shellfishing areas and the species most frequently gathered at each.

Archaeological material from the next bay east of Pari indicates that the main Pari species, with few exceptions, have maintained their present position for the past 2 000 years. The species found in Taurama middens are listed in Table 3. The most successful being *Strombus luhuanus, Nerita albicilla, Strombus gibberulus gibbosus, Nerita polita, Turbo crassus, Nerita undata* and *Lambis lambis* amongst the gastropods; with *Anadara antiquata, Atactodea striata, Gafrarium tumidum, Asaphis violascens* and *Tridacna* species being the most important bi-

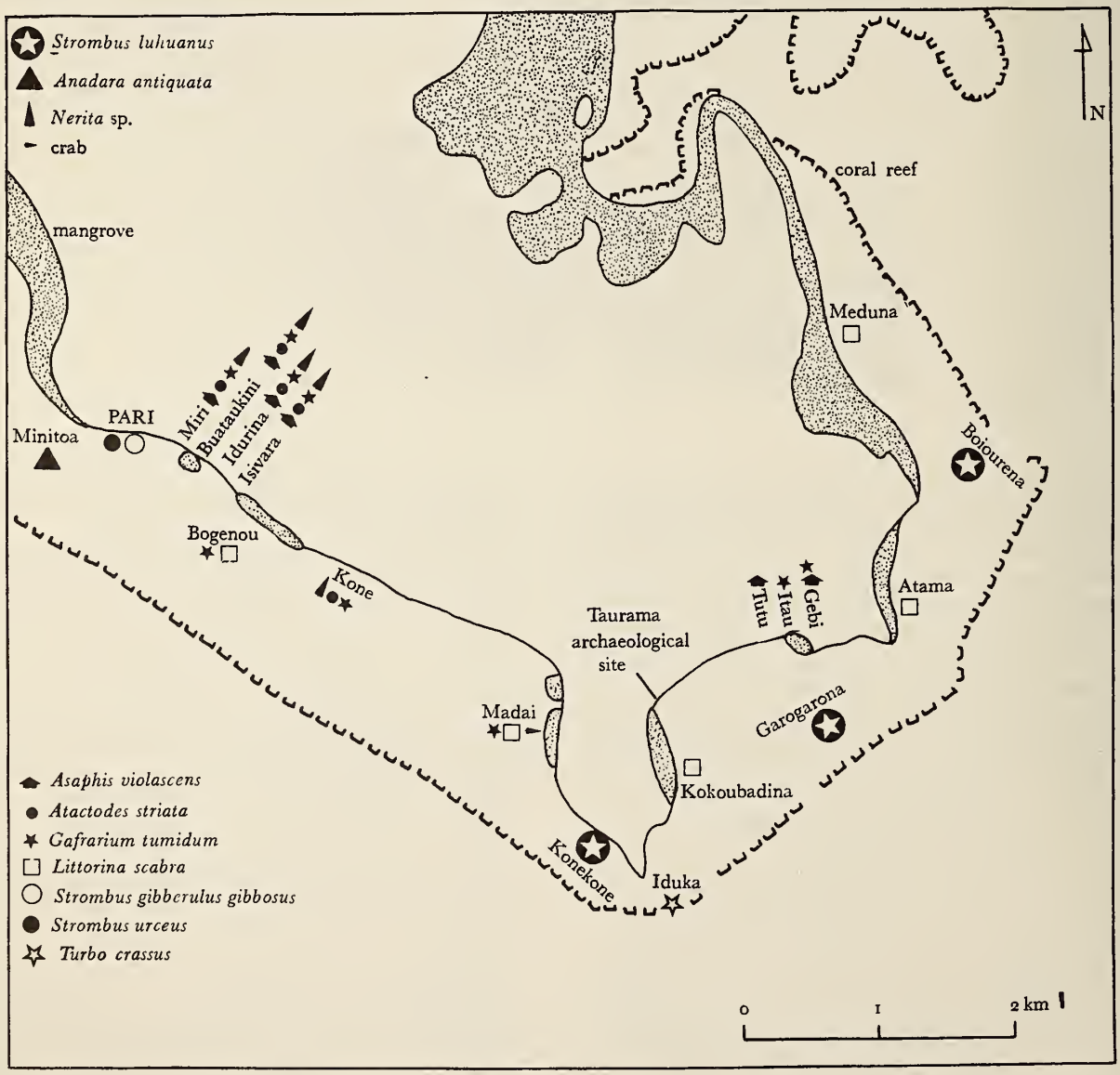


Figure 2

Main Pari Shellfishing Areas

Table 3

Shellfish species in Taurama archaeological site

Herbivorous Molluscs	Excavation levels of square AJA/7x																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21
Strombus luhuanus Linnaeus, 1758	5	4	3	5	5	4	3	2	2	2	2	3	4	3	3	2	3	3	3	1
Nerita albicilla Linnaeus, 1758	2	2	3	5	5	3	3	2	2	3	4	3	4	5	5	4	4	4	2	3
Strombus gibberulus gibbosus (Röding, 1798)	1	1	1	3	2	1	1	1	1	1	1	2	2	2	3	2	1	1	1	1
Nerita polita Linnaeus, 1758	1	1	1	3	2	1	1	1	1		1	1	2	1	2	1	1	1	1	1
Turbo crassus Linnaeus, 1758	1	1	1	3	3	1	1	1	1		2	2	2	3	2	1	1	1		1
Nerita undata Linnaeus, 1758	1	1	1	3	2	1	1	1	1	1		1	1	1			2		1	1
Lambis Lambis (Linnaeus, 1758)			1	2	1	1	1	1		1	1	1	1		1	1		1		1
Cypraeidae species	2	1		3	1	1	1			1		1	1	2	2	2	1	2	1	
Clypeomorus moniliferus (Kiener, 1841)			3	1	1			1	1	1	2	3	1	3	4	2				
Trochidae species	1			1	1	1			1		1	1	1	1	1			1	1	
Littorina scabra (Linnaeus, 1758)	1	1		1		1					1	1		1	1	1	1		1	
Planaxis sulcatus (Born, 1780)				1	1			1	1	1	1	1		1	1	1		1		
Turbo cinereus	1	1	3	1					1	1	1	2	1	2						
Cerithium species	1	1		1	1	1	1	1				1		1			1		1	
Nerita squamulata Le Guillou, 1841			1	1	1	1	1								1	1		1		
Monodonta labio (Linnaeus, 1758)	1	1		1	1		1	1						1				1		
Trochus niloticus Linnaeus, 1767				1	1	1		1								1	1	1	1	
Cerithium nodulosum Bruguière, 1792				1	1		1		1			1		1		1				
Nerita planospira Anton, 1839					1		1			1			1		1	1		1		
Strombus labiatus labiatus (Röding, 1798)				1	1	1							1	1	1			1		
Nerita phcata Linnaeus, 1758				1									1	1			1			
Strombus aurisdianae Linnaeus, 1758				1		1								1	1					
Trochus maculatus Linnaeus, 1758				1		1											1			
Angaria delphinus (Linnaeus, 1758)										1				1						
Cerithium aluco (Linnaeus, 1758)					1							1								
Tectus pyramis (Born, 1778)	1																	1		
Strombus canarium Linnaeus, 1758					1															
Strombus lentiginosus Linnaeus, 1758				1																
Strombus urceus urceus Linnaeus, 1758															1					
Predaceous Molluscs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21
Conidae species				2	1	1		1	1		1	1	1	1	1	1	1	1	1	
Polinices melanostomus (Gmelin, 1791)				1	1		1				1	1	1		1					
Mitridae species				1				1				1		1	1		1	1		
Conus marmoreus Linnaeus, 1758			1		1	1				1							1		1	
Cymatiidae species														1	1	1				
Murex torrefactus Sowerby, 1841	1			1										1						
Cymatium muricinum Röding, 1798														1	1					
Cantharus fumosus Dillwyn, 1817														1						
Murex permaestus Hedley, 1915														1						
Vasum turbinellus (Linnaeus, 1758)						1														
Filter Feeding Bivalves	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21
Atactodea striata (Gmelin, 1791)	5	4	4	5	5	5	3	3	3	1	3	3	5	3	3	3	1	1		1
Anadara antiquata (Linnaeus, 1758)	4	3		4	4	3	2	1	1				2		1			1	1	
Gafrarium tumidum (Röding, 1798)				1	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1	
Chama reflexa Reeve, 1846						1		1	1	2		3	1	2	2	1	1	1	1	
Periglypta puerpera (Linnaeus, 1771)					1	1	1	1			1	1	1	1	1		1	1		1
Asaphis violascens (Forskål, 1775)			1	1	1	1	1	1				1			1					1
Barbatia species	1								1			1	1	1	2	1	1	1		
Crassostrea commercialis (Iredale & Roughley, 1933)					1	1				1		1			1	1	1	1		
Davila plana (Hanley, 1843)					1							1	1		1	1	1			
Saccostrea echinata (Quoy & Gaimard, 1834)					1				1		1				1	1	1			
Latona faba (Gmelin, 1791)					1	1			1					1		1				
Pycnodonte hyotis (Linnaeus, 1758)						1						1						1	1	
Geloina coaxans (Gmelin, 1791)														1	1				1	
Mytilidae family																1				
Algal Symbiotic & Filter Feeding Bivalves																				
Tridacna species	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1		1	1	

Relative frequency = 1: 1-9, 2: 10-19, 3: 20-49, 4: 50-99, 5: 100+

valves. The great diversity of less abundant species is also evident.

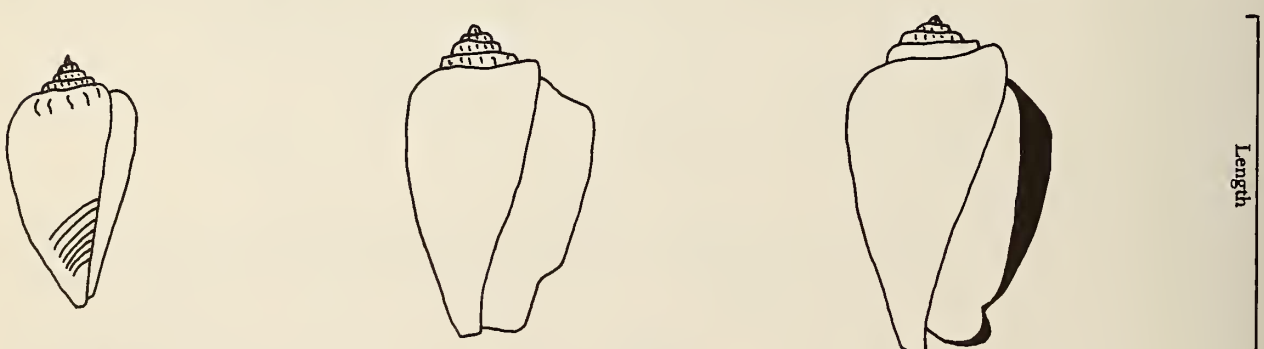
Two of the most frequently gathered molluscs at Pari are *Strombus luhuanus* and *Anadara antiqua.* In order to gain a long-term view of shellfishing on the Pari-Taurama coral reef the prehistoric and present day populations of these 2 species are examined below. *Strombus luhuanus* and *A. antiquata* were chosen because their differing diets and habitats meant that any comparable changes found in the nature of their gathered populations over a period of time would more likely be due to human predation than environmental changes in food supply or substrate.

The Pari *Strombus luhuanus* beds offshore at Konekone, Garogarona and Boiourena are now said to be well fished. Apart from the personal observations of people who are familiar with the area and its resources, the existence of considerable exploitational pressure on the *S. luhuanus* beds is evident from the shells themselves.

The morphological nature of the shells being gathered from Garogarona, for instance, demonstrate all the changes associated with heavy human exploitation. Shellfishing has produced a consistent mortality of the large and mature individuals within the population which is far higher than usual for the species. Hence the population shows a marked reduction in age range and overall size. The younger age classes are now dominant because of the heavy level of exploitation. This is evident when the length range and presence of juvenile characteristics (*i. e.*, absence of lip thickening, fluting on outside whorl, presence of columellar folds and absence of siphonal notch (Figure 3)) in the lightly exploited population from the bed east of the sandspit on nearby Motupore Island (The University of Papua New Guinea Research Island), which is gathered by only one family, is compared with that of the heavily exploited Garogarona bed (Figure 4). The bimodal curve of these 2 populations is probably due to sexual dimorphism. In the Strombidae, male shells are usually smaller than females (Abbott, 1960: 33). When gathering thins out a dense population, thereby increasing the supply of food for the remaining individuals, a corresponding increase in the growth rate allows these favoured individuals a greater size while still exhibiting juvenile features. This phenomenon would explain the distribution of juvenile traits in the Motupore population shown in Figure 4.

In archaeological samples of *Strombus luhuanus* the presence or absence of lip thickening was found to be the most reliable observation. It is very difficult to accurately record siphonal notch development in thin-lipped individuals as the lip is often broken, and observations of columellar folds and fluting can be unreliable in badly corroded specimens.

The following observations were taken into consideration when examining the modern *Strombus luhuanus* populations and those from the archaeological deposits; shell



Juvenile

Thin lipped
Fluting on body whorl
Presence columellar folds
Lacking siphonal notch

Youthful

Thin lipped
Fluting on lower whorls
Lacking columellar folds
Presence siphonal notch

Mature

Thick lipped
Fluting only on upper whorls

Figure 3

Developmental Stages in *Strombus luhuanus*
(from Swadling, no date: a)

Table 4

Nature of modern and prehistoric populations of *Strombus luhuanus*. Linnaeus. 1758

	Sample number		Shell length	% pop. 45mm+ in length	% pop. with lip thickening
MODERN					
Motupore Is.	100	light exploitation	45-59	100	94
Garogarona	100	heavy exploitation	36-48	17	48
PREHISTORIC		excavation level			
Taurama Excavation	100	1	32-56	55	79
	70	2	36-52	37	52
	30	3	36-50	33	57
	100	4	34-55	51	79
	100	5	30-55	49	56
	59	6	38-51	40	70
	29	7	38-52	41	63
	15	8	39-50	33	67
	20	9	35-47	25	60
	16	10	34-52	31	75
	15	11	33-52	40	54
	31	12	29-54	33	58
	70	13	31-52	32	58
	36	14	31-57	30	39
	39	15	34-57	35	49
	14	16	35-58	64	43
	22	18	33-54	27	50
	31	19	29-54	22	46
	29	20	34-54	20	32
	9	21	34-43	0	12
		base of site			
		(no sample was available for excavation level 17)			

length, the percentage of the population 45mm+ in length and the percentage with lip thickening (Table 4). The maximum lengths found in archaeological sites at Taurama and Motupore Island suggest that there are no great environmental differences in growth potential along this stretch of coast. Forty-five mm was taken as being close to the upper limit of the youthful size range (Figure 4). Where possible all samples consisted of 100 shells. When more than 100 measurable shells were available, the total population was screened through 35, 40, 45, 50 and 55mm holes and counted. Each size was then sampled according to its relative frequency.

Before discussing further the Taurama excavation findings on *Strombus luhuanus* a brief report of the observations made of *Anadara antiquata* will be given. This bivalve is found buried at little depth in areas of sea grass in the intertidal zone of reef platforms. At Pari the best bed is immediately out from the west end of the village. East of Port Moresby, where the reef becomes much narrower beyond Gabagaba to Hood Point, this species is the main shellfish gathered. It was along the latter stretch of coast at Walai that the April 1972 paralytic shellfish poisoning occurred. *Anadara antiquata* was the main shellfish involved. Three children died and over 20 people were hospitalised (MACLEAN, 1974: 2).

The following observations were made for each *Anadara antiquata* population. Length, which was taken from the anterior to posterior ends of the shell, and the depth, which was measured over the umbo to the edge of the inner lip below. Where possible each sample consisted of 100 shells. The modern Pari *A. antiquata* bed is

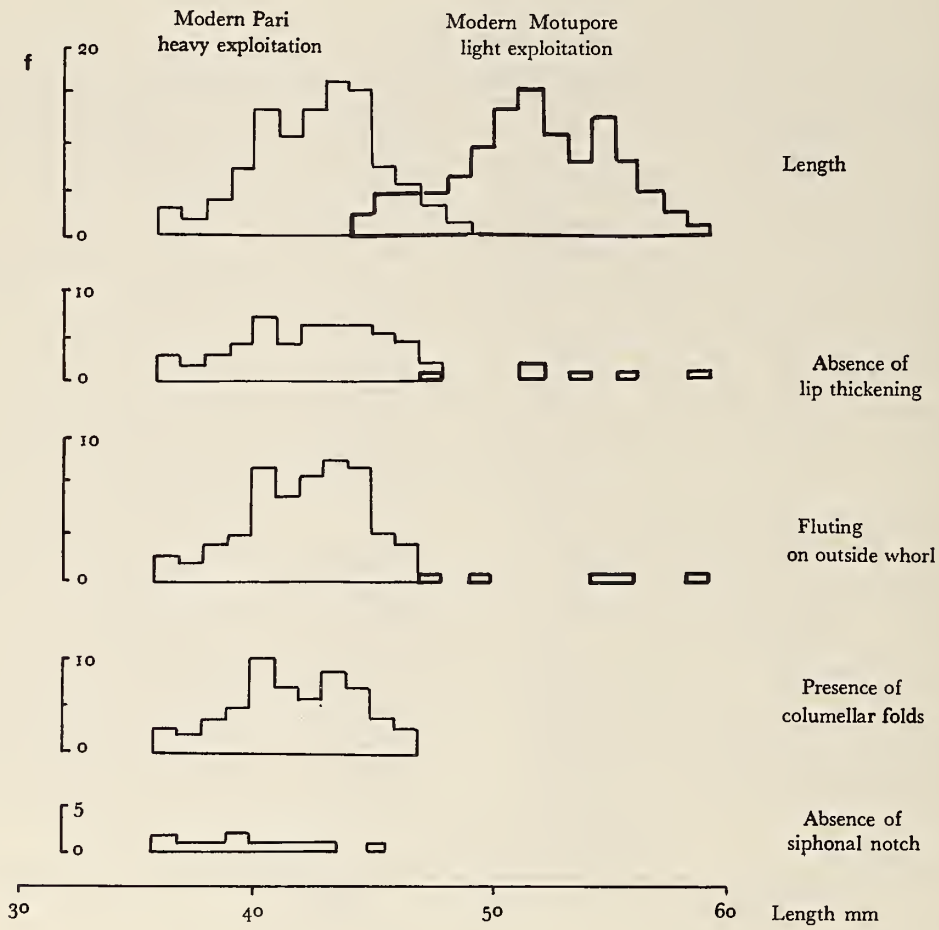


Figure 4

Distribution of Juvenile Traits in Lightly and Heavily Exploited Populations of *Strombus luhuanus* (from SWADLING, no date: a)

said to be well fished. The bed out from Walai village, where the population is less than 100 people, is under less gathering pressure. No relatively unexploited population of *A. antiquata* was obtained. The findings are listed in Table 5.

The archaeological square (AJA/7x), from which the Taurama midden material was excavated, did not always fulfill the same purpose throughout the occupation of the site. Although the square was clearly the site of a rubbish dump when the site was abandoned, that had not been the case during the total site occupation. The lower frequency found in other layers may mean that the dumps were then located elsewhere. Thus, the frequency of shellfish in the different layers of one square does not necessarily equate with varying rates of consumption through time; unless supported by total site excavation data and evidence for changing levels in shellfish exploitation.

Strombus luhuanus is one of the most abundant gastropods in the Taurama midden. The population of this species in the different excavation levels (each level being

Table 5

Nature of modern and prehistoric populations of *Anadara antiquata* (Linnaeus, 1758)

	Sample number		Shell length mm	% pop. 50mm+ in length only when 5+ shells	Depth range mm	Average depth mm
MODERN						
Minitoa	57	heavy exploitation	29-52	4	7-13	9.1
Walai	100		30-59	13	7-17	11.9
PREHISTORIC		excavation level				
Taurama	60	1	30-73	40	7-28	13.9
Excavation	30	2	33-65	23	8-20	12.7
	—	3	—	—	—	—
	78	4	33-62	34	8-19	12.8
	50	5	34-60	28	8-17	12.4
	26	6	32-71	38	8-28	14.7
	10	7	29-52	30	6-15	11.7
	1	8	49	—	14	—
	1	9	39	—	10	—
	—	10-12	—	—	—	—
	13	13	36-52	23	9-15	11.6
	—	14	—	—	—	—
	2	15	41-52	—	10-17	—
	—	16-18	—	—	—	—
	2	19	46-50	—	16	—
	2	20	30-63	—	8-20	—
	—	21	—	—	—	—
		base of site				

(no sample was available for excavation level 17)

approximately 10 cm in depth) exhibit the features characteristic of human exploitation. Despite any perceptible change in the length range, probably due to the overall abundance of this species, there is a marked change in the nature of the populations through time. Morphological observations indicate that exploitation was most demanding in the oldest levels of the site with a decrease in demand occurring during the subsequent occupation of the site. The same observation is in part evident in the less abundant *Anadara antiquata* populations.

The 2 000 years of occupation found at Taurama record the occurrence of a number of pottery styles. The earliest of these occupations was that of a community making what has come to be termed Red Slip pottery. This potting industry has its closest parallels in the Oceanic Lapita tradition. Dating from 1000 A. D. another style of pottery appears. Much of this pottery, which has been found at Eriama, Nebira 2, Boera and Taurama, is similar to prehistoric Goodenough, Amphlett Island and Trobriand Islands pottery and on this basis was labelled 'Massim' by Bulmer (1971). This style may have developed into the tradition which is dated to about 1200 A. D. at Motupore Island. Comparable pottery has been found at Nebira 2, Taurama, Boera and Urourina on Yule Island. Finally, within the past 300-200 years Motu pottery fashioned as observed by early European visitors became the dominant potting tradition.

These potting industries were thought to reflect the occupation of the Port Moresby area by successive groups of people. The Red Slip potting tradition, which persisted in the area for over 1000 years, was taken to represent a group who were favoured by the environment and who departed only when it deteriorated, perhaps due to their own interference, or when competition drove them out. All subsequent settlement along this coastline was thought to have followed a similar pattern until the Motu were able to establish a working economy based largely on imported food (Bulmer, 1971: 81).

The *Strombus luhuanus* and *Anadara antiquatus* populations do not revert to an unexploited state at any time during the Taurama occupational sequence. This suggests that the Pari to Taurama coastline was subjected to fairly

continuous human occupation since the time of initial settlement, though the settlers need not always have lived at the same site. If the area and its shellfish beds had been abandoned, a situation should have arisen like that for Otakanini pa (fort) near Auckland, New Zealand. There the beginning of site occupation periods are characterised by relatively unexploited cockle (*Chione stutchburyi* (Gray, 1828)) populations, whereas at each time the site was abandoned the shellfish display all the characteristics of heavy human exploitation. These changes in shellfish gathering at Otakanini probably reflect the practice of shifting agriculture (Swadling, 1972: 90).

CONCLUSION

The mollusc species which are today gathered at Pari village, in the Central Province of Papua New Guinea, are with few exceptions the same as those found in the Taurama archaeological site located in the next bay to the east. This means that these shellfish have been a valued and viable natural resource in the area for the last 2 000 years.

The prehistoric populations of 2 of the most frequent species, *Strombus luhuanus* and *Anadara antiquata*, do not revert to an unexploited state at any time during the Taurama occupational sequence. During the prehistoric period exploitational pressure was heaviest at the time of initial occupation. The subsequent decrease in exploitational pressure may reflect the increasing importation of garden produce and luxury protein foods obtained in exchange for pots and shell ornaments. Today exploitation is again at a high level and many beds appear to face depletion.

ACKNOWLEDGMENTS

I wish to thank Tahuni Gaba, Puka Gaba, Karoho Heao, Vagi Kevau and Kaia Aire of Pari; Councillor Vakai, Iovea Aua and Peter Naime of Delena; Margaret Obi of Bereina; Kila Lega, Vali Geno, Laka Gulu and Geraga Geraga of Walai; and W. Dihm of Vabukori for their patience and help.

For assistance with laboratory work I wish to thank Saem Manjnep and Gabrielle Johnston.

I am grateful to Walter O. Cernohorsky (Auckland Museum) and Winston Ponder and P. Coleman (Australian Museum) for checking and correcting many dubious scientific identifications. Any remaining errors are my responsibility.

Finally, I wish to thank Susan Bulmer for the opportunity to work on the shell midden material from Taurama.

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